



# *An Energy Efficiency Workshop and Exposition*

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Energy 2001

Walking on Air – Energy

Efficient, Flexible and Adaptive  
HVAC Distribution Systems

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- The background is a detailed architectural cross-section of a building. It shows multiple floors with various HVAC components. On the left, there's a vertical shaft with air entering at different levels, indicated by arrows. In the center, a person is sitting at a desk with a computer, with arrows showing air circulation around them. On the right, there's another vertical shaft with air being distributed downwards. The drawing uses fine lines to represent structural elements like walls, floors, and ceiling grids, and thicker lines for HVAC ducts and equipment. A yellow vertical line is on the left, and a yellow horizontal line is at the bottom right.
- Trends in HVAC Design
  - New HVAC Applications

# Changes in HVAC Design Criteria

- Cooling Capacity – 5-6 Watts/sq ft
  - Increased Loads
  - Higher Population Density
  - More Equipment
- Overtime Air Conditioning
  - Reduced Overtime Cooling Cost
  - More Overtime Cooling Needs
  - Flex Hours
- Supplementary and 24 Hour Cooling
  - Special Cooling Needs for Technology Rooms, Conference Rooms, High Load Areas

# Human Factor

- More Fresh Air
  - Recognition of Greener Buildings (LEED)
  - Accommodate Excess Air for Conference/Assembly Areas
  - Accommodate Outside Air During Overtime Hours
- Task Cooling
  - Control One's Own Environment



# Recognition of Changes in Technology/Flexibility

- Changes in Technology = Changes in Load Distribution
- Development of Pathways to Deal with Load Migration
- Modifications to Physical Work Environment
- Fast, Low Cost Changes

# Sustainable Design (Green Buildings)

A detailed architectural cross-section of a building. In the center, a person is seated at a desk with a computer monitor. To the left, there is a large indoor plant. The building's structure shows multiple floors, columns, and beams. A large curved arrow on the right side indicates a flow or cycle. The title 'Sustainable Design (Green Buildings)' is written in yellow at the top. A yellow vertical line is on the left, and a yellow horizontal line is at the bottom right.

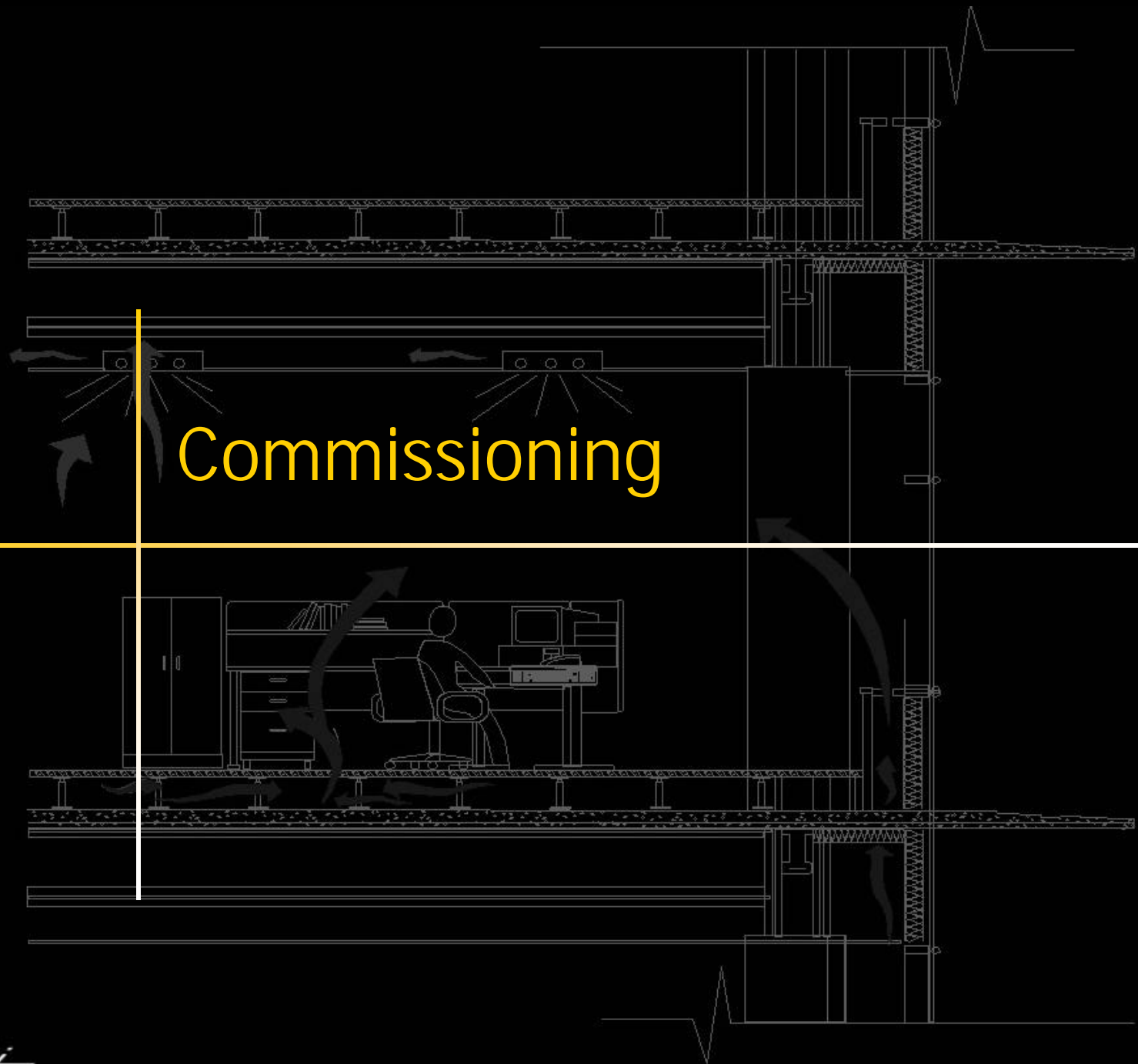
- Environment
- Energy
- Materials
- Reuse of Resources
- Renewables
- Future Flexibility

# LEED Building Rating Scale

<u>Category</u>	<u>Maximum Points</u>
Sustainable Sites	14
Water Efficiency	5
Energy & Atmosphere	17
Materials & Resources	13
Indoor Environmental Quality	15
Total Core LEED Rating System Points	64
<u>Innovation and Process Points</u>	<u>5</u>
Total Points Possible	69

# Innovative Strategies for Sustainable Design

- Fuel Cells
- Dynamic Exterior Wall Systems
- Passive Single Wall Systems
- Underfloor Air Distribution System
- Natural Ventilation
- Wind Power
- Solar Power
- Geothermal
- Peak Shaving (Plant Efficiency)
- Cogeneration
- Office Equipment Power Conservation
- Photovoltaic
- Hybrid Systems



Commissioning



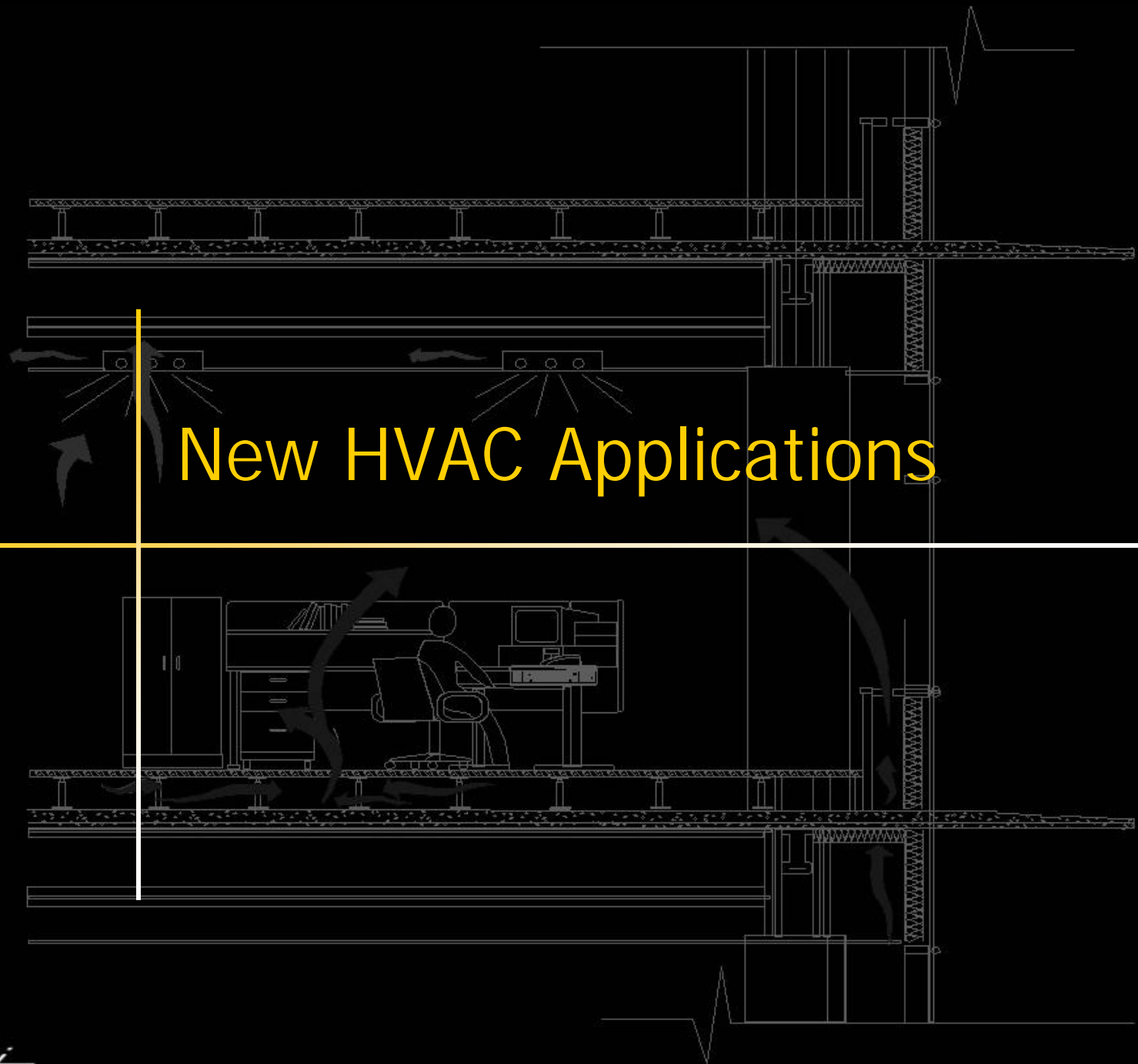
# Commissioning Goals

- Communication Between Designer & Operator
- To deliver a fully functional and verified HVAC system that complies with the design intent.
- To provide adequate training to building personnel that will allow them to properly maintain and operate these systems.
- To turn over proper documentation showing how the system was designed, installed and intended to operate.

# Benefits

- Training and improved operator knowledge
- System performance
- Reduced downtime
- Improved IAQ and comfort conditions for occupants
- Reduced number of deficiencies during construction
- Properly documented and catalogued records, as-built drawings and O&M manuals.
- Assures Operating Cost Savings

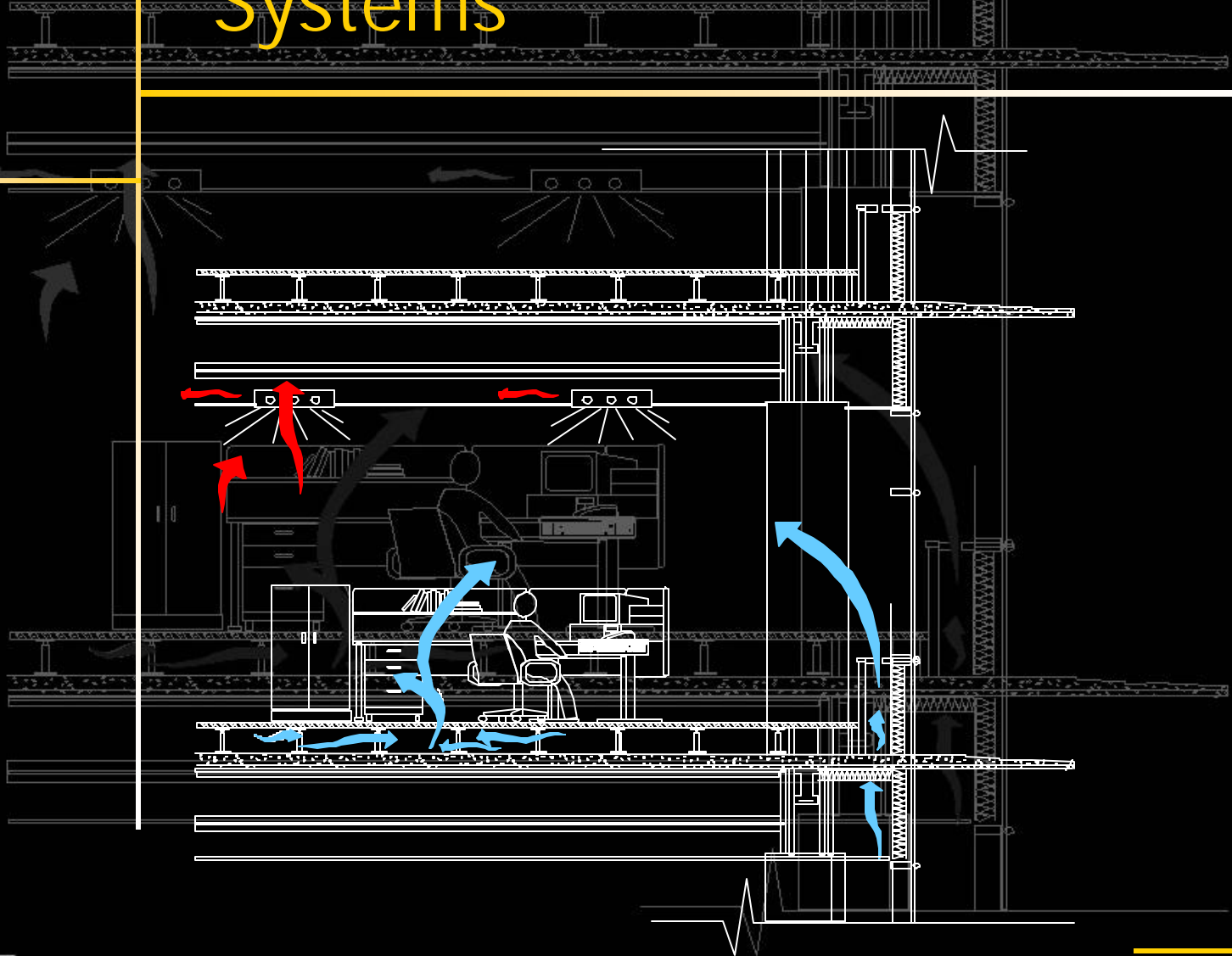


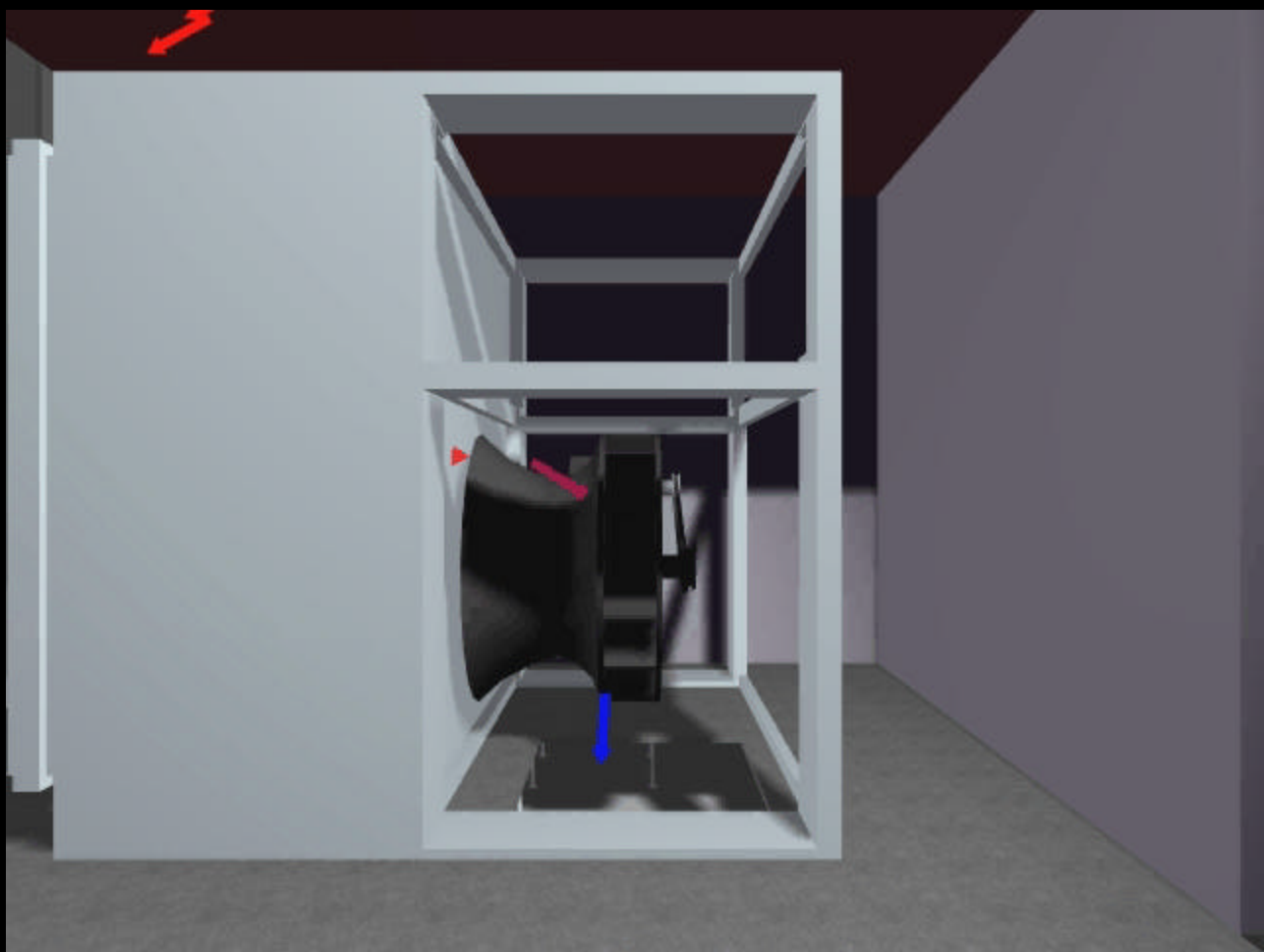


# New HVAC Applications

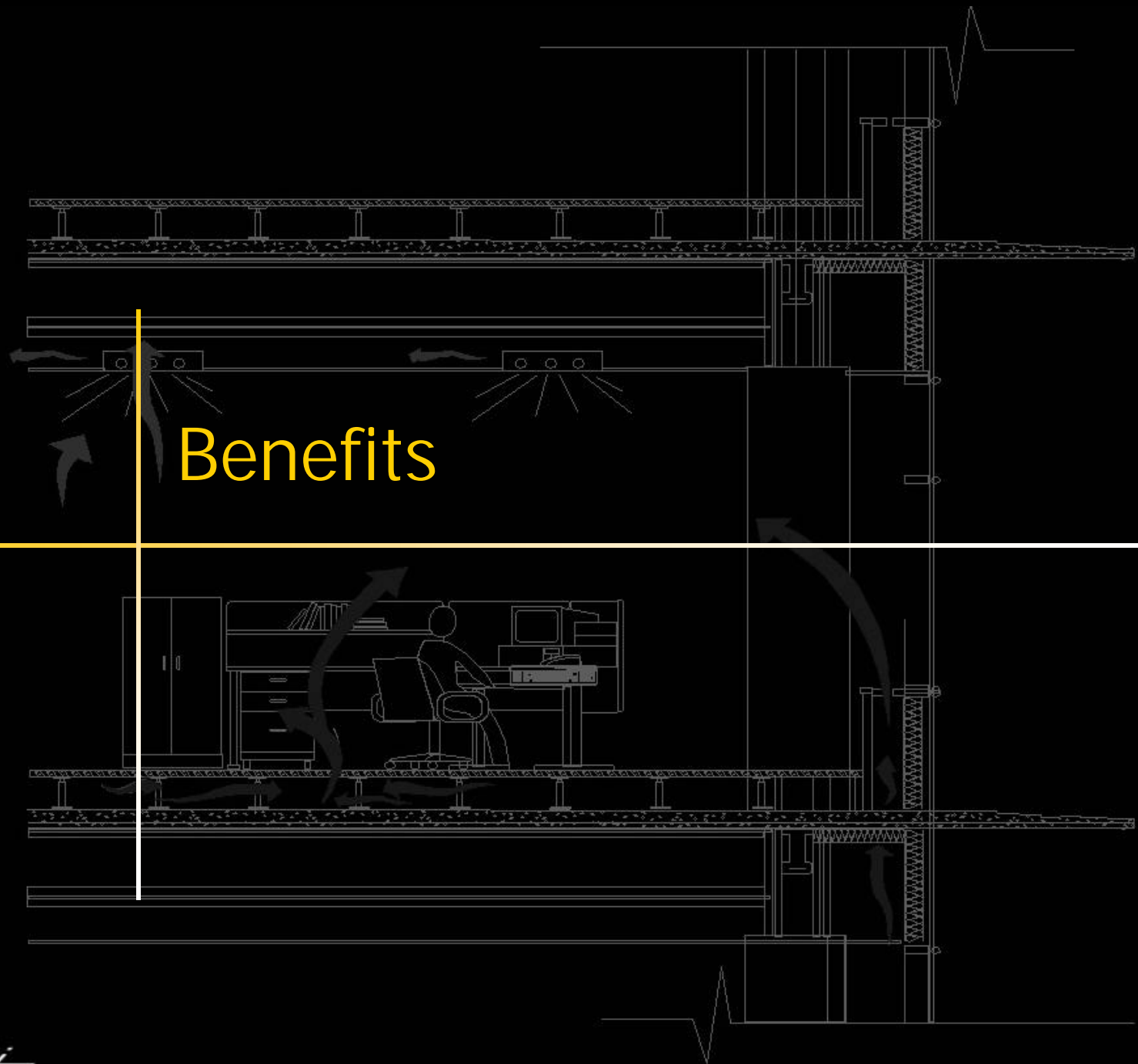


# Underfloor Air Distribution Systems









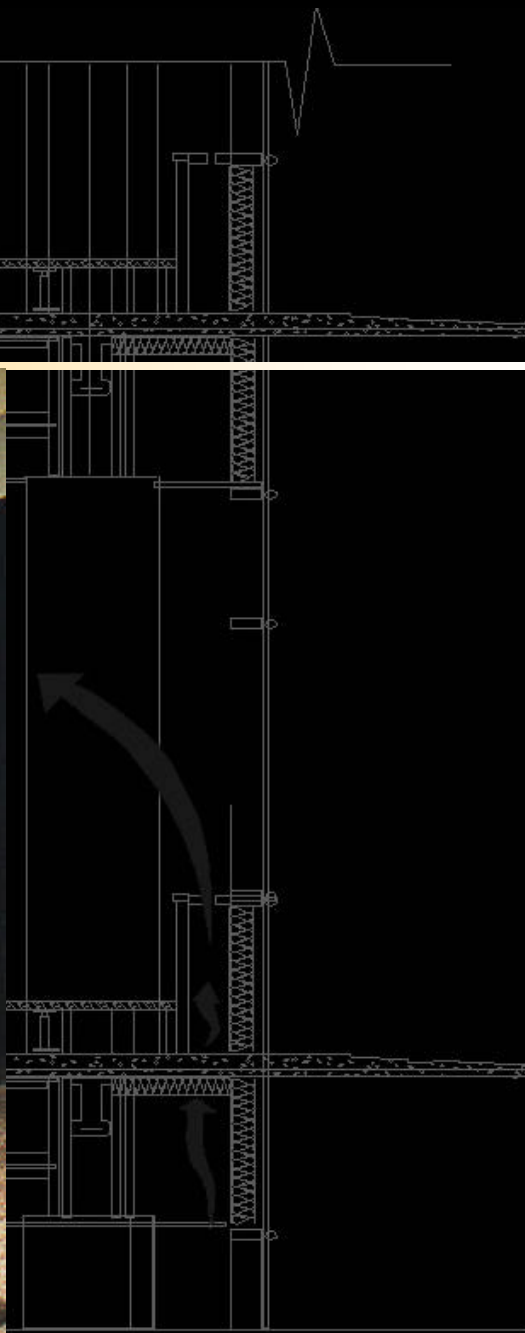
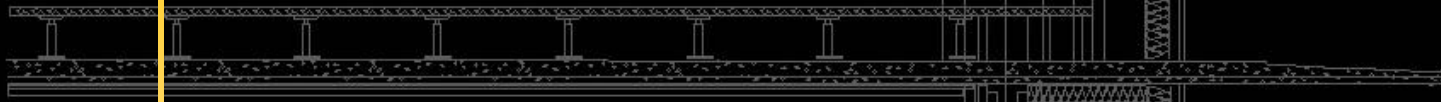
Benefits

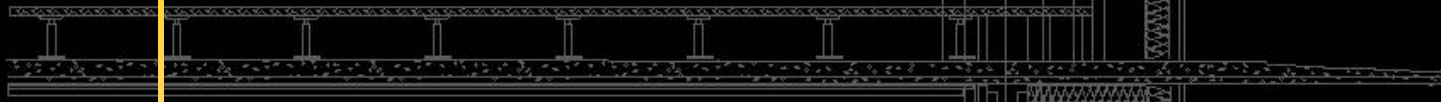
The background of the slide is a detailed architectural cross-section of a building. It shows multiple floors, structural columns, and a ceiling with various mechanical components. A person is depicted sitting at a desk on one of the floors, with a computer monitor and some books. Large, curved arrows indicate the movement of air throughout the space, suggesting a ventilation system. The title 'Improved Thermal Comfort' is written in a large, bold, yellow font at the top. A list of five bullet points is centered on the slide, with the last one, 'Increased Productivity', also in yellow. The bottom left corner features the 'Cosentini' logo in a cursive script, and the bottom right has a yellow L-shaped graphic element.

# Improved Thermal Comfort

- Improved Air Movement
- Occupant Regulation of Air Flow
- Occupant Regulation of Temperature
- Improved Occupant Satisfaction
- Increased Productivity







# Indoor Air Quality

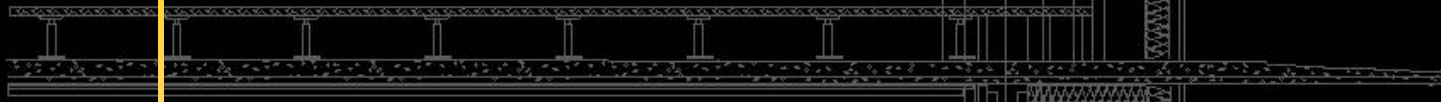
A detailed architectural cross-section of a building, likely a multi-story office or residential structure. The drawing shows various rooms, including a large open space with a person sitting at a desk with a computer. The air flow is indicated by arrows, showing fresh air entering from the left and circulating throughout the space. The ventilation system is highlighted, showing air being drawn in from the outside and distributed through the building's internal structure. The title 'Indoor Air Quality' is prominently displayed in a large, bold, black font at the top left of the image.

- Increased Ventilation Effectiveness (Fresh Air)
- Cleaner Environment
- Easy Access for Maintenance of Air Stream
- Additional Air-Side Free Cooling Hours



# System Flexibility

- Ability to Relocate People and Equipment Cost Effectively and Quickly
- Perfect Application for Teaming Concept
- Ability for Task Cooling
- Owens Corning Saved \$500,000 the First Year



Cosentini

5 10 '96

# Energy/Operating Costs

- Reduced Energy Usage
  - Only Cool where People/Equipment are Located
  - Only Condition Heat Load in Comfort Zone
  - Higher Supply Air Temperature
  - More Free Cooling Hours
  - Reduced Refrigeration Energy
  - Lower Overall Air Circulation than Standard
  - Lower Fan Energy
- Lower Maintenance Costs (Less Devices to Maintain)



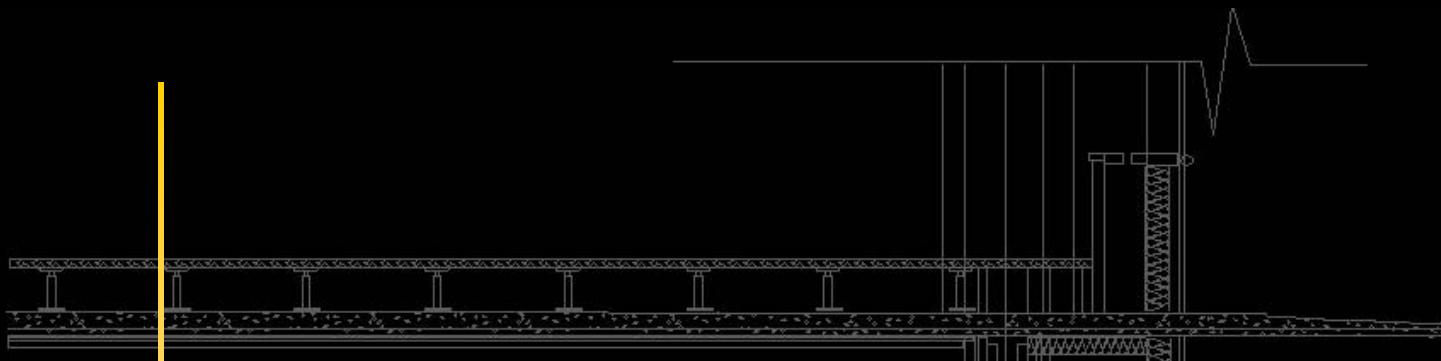
# Life Cycle Building Cost

- Reduced Life Cycle Building Cost
- Lower Cost to Make Space Changes
- Reduced System Maintenance
- Lower Energy Costs

# Additional Benefits

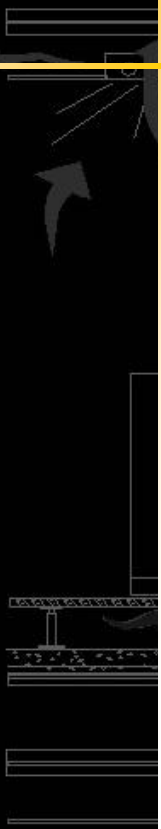
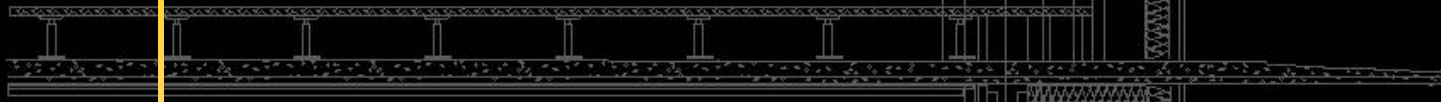
- Electro-Mechanical System Integration
- Modular Power Cabling Distribution
- Modular Data Telecommunications Distribution
- Integration with Furniture/Partition Systems





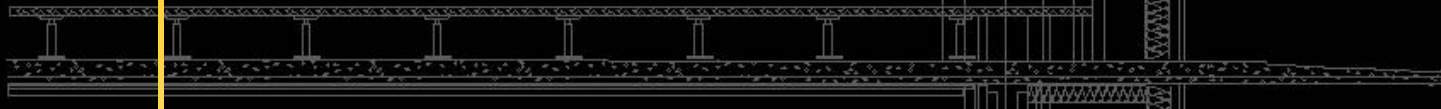
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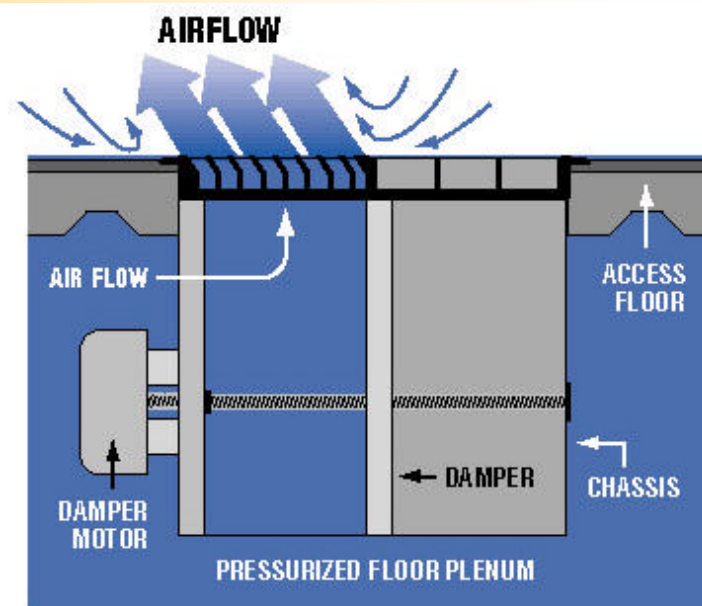
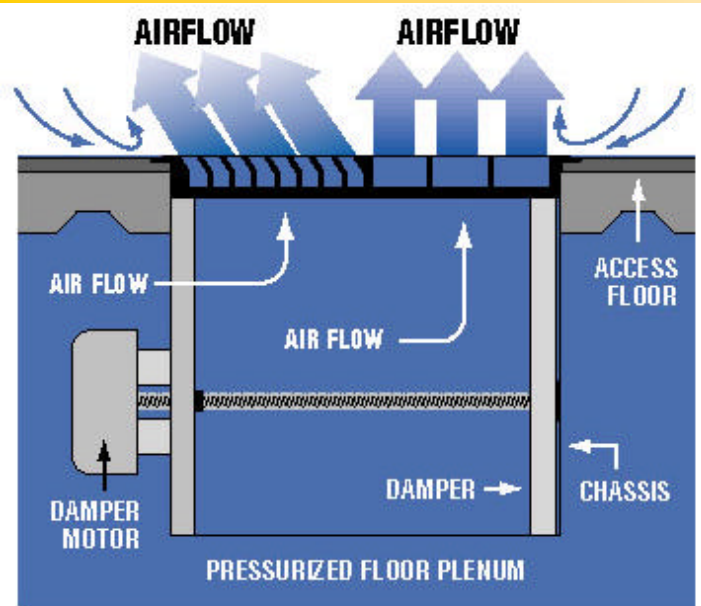
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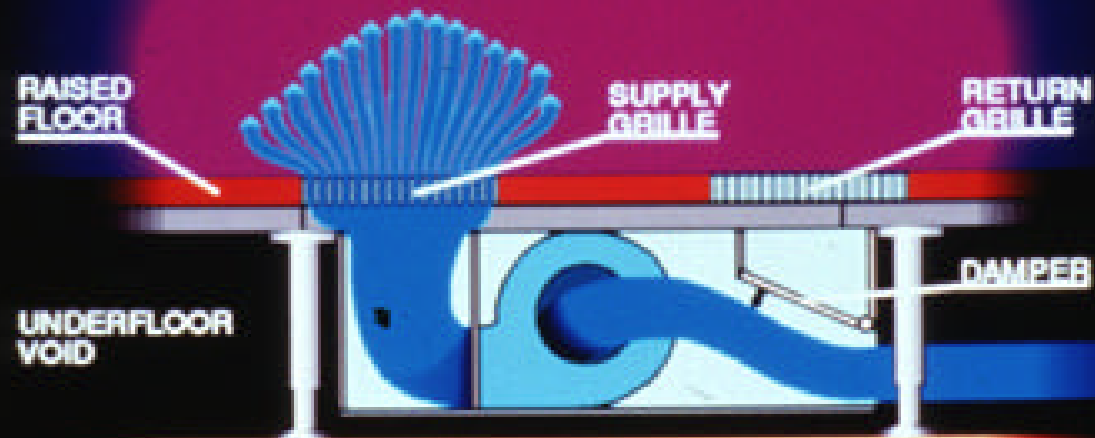


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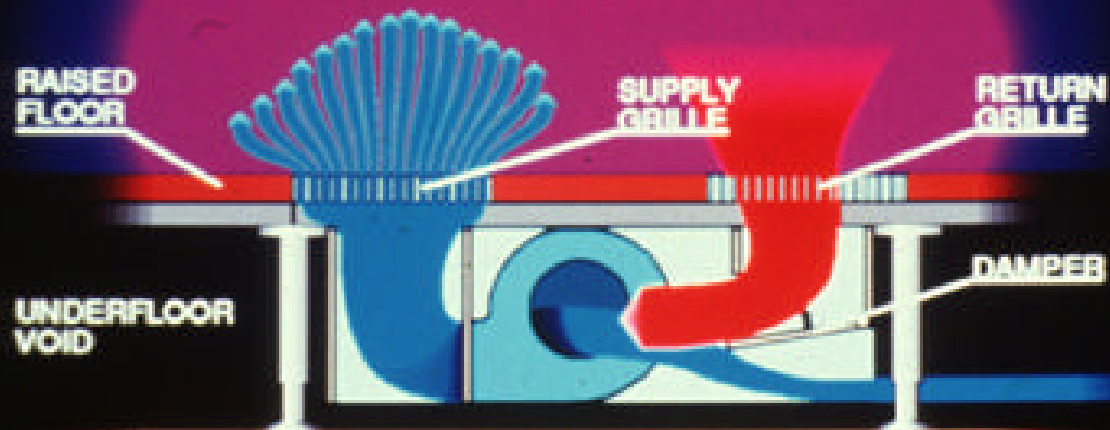




# FTU Operation Diagram Cooling/Heating Mode



# FTU Operation Diagram Recirculation Mode



# Design Objectives

- Space requirements
  - Reduced Ceiling Plenum Requirements for Return Air, Sprinkler and Lighting
  - If No Ceiling, Need to Insure Heat and Contaminants are Above Occupied Zone
  - If No Ceiling and Private Office, Need to Insure Adequate Induction for Return Air
  - Raised Floor Height (10-12 Inch)

# Perimeter Heating/Cooling Options

A detailed architectural cross-section of a building, likely a multi-story office or commercial structure. The drawing shows various levels, including a ground floor with a desk and chair, and upper floors. The focus is on the perimeter of the building, where heating and cooling systems are being discussed. Arrows indicate air flow and heat transfer between the interior and exterior. The title 'Perimeter Heating/Cooling Options' is prominently displayed at the top in a large, bold, black font.

## ■ Perimeter Heating/Cooling Strategies

### ■ Reduced Loads

- Curtain Wall Efficiency (Shading Coeff., U-Value)
- Type of Shading System

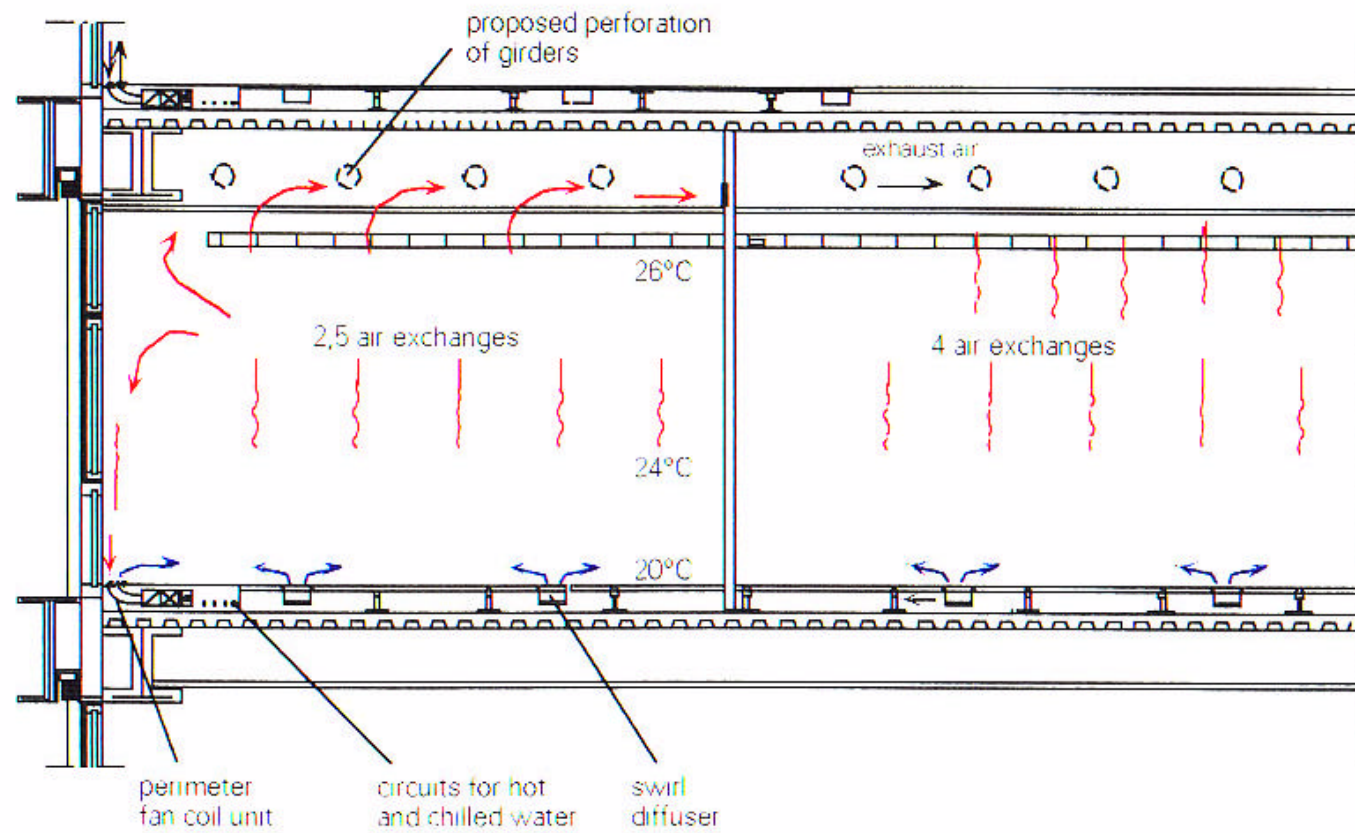
### ■ Common System

- Use Interior Air with Booster/Static Heating,
- Radiant, or Heating Coil

### ■ Independent System

- All Air VAV
- Air/Water

Summer:





# General Issues

- Overtime A/C Strategy/Under Floor Partitioning
- Multiple Tenants Per Floor
- Integrated Lighting/Sprinkler Configuration Allows for Flexible Partition Relocation
- “Exiting” Strategy - Speculative Office Use

The background is a detailed architectural section drawing of a multi-story building. It shows various levels, rooms, and structural elements like columns and beams. A prominent yellow crosshair is overlaid on the drawing, with a vertical line and a horizontal line intersecting. The text 'Case Studies' is written in yellow, bold, sans-serif font, positioned to the right of the vertical line and above the horizontal line. Below the horizontal line, a list of project names is written in white, sans-serif font. The overall style is technical and professional.

## Case Studies

Owens Corning  
HA•LO

FedEx Headquarters  
Woodfield Preserve



# Owens Corning World Headquarters

1997 – Occupied  
450,000 sq ft  
Toledo, OH





# Owens Corning World Headquarters





# Owens Corning World Headquarters



# Owens Corning World Headquarters





# Owens Corning World Headquarters





# Owens Corning World Headquarters



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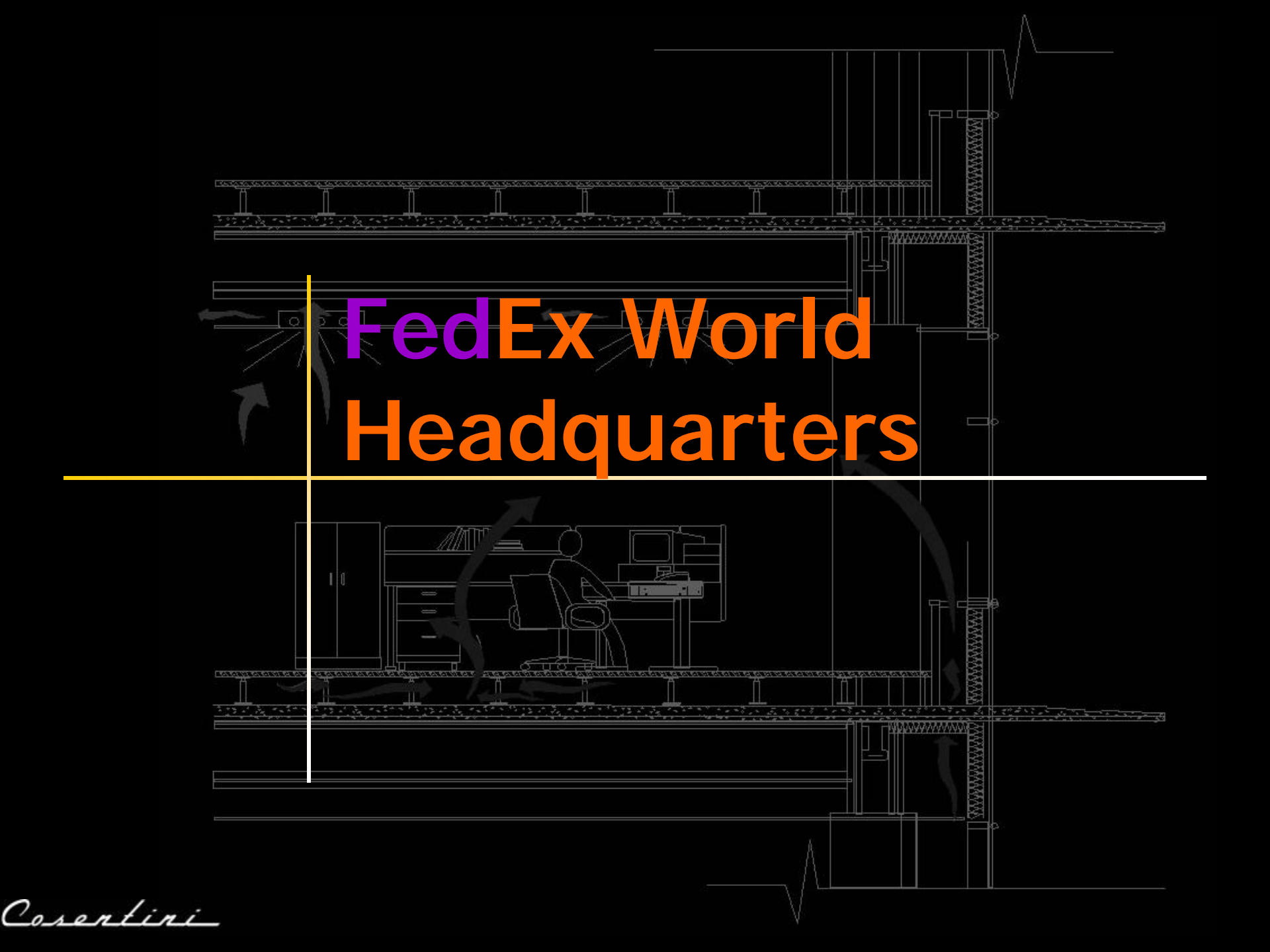




"The benefits - comfortable workspace, flexibility, energy savings, and quality environment - of underfloor distribution make the system choice a true success for Owens Corning."

Jim Eckert, director of Corporate  
Facilities,  
Owens Corning Headquarters





The image is a technical architectural cross-section of a building. It shows multiple horizontal levels or floors. In the middle section, a person is seated at a desk with a computer monitor and keyboard. To the left of the desk is a tall cabinet. Several curved arrows indicate the flow of air or movement within the space, showing air entering from the left, circulating around the desk area, and exiting towards the right. The building's structure, including walls, floors, and ceiling, is depicted with fine lines. The title 'FedEx World Headquarters' is overlaid on the central part of the drawing.

# FedEx World Headquarters

# FedEx World Headquarters

- Introduction
  - The FedEx World Headquarters
- The Project
- Why FedEx Chose The Underfloor Air System
- Corporate Needs
- Costs

# FedEx World Headquarters

2001 – Occupied  
1.1 Million sq ft  
Memphis, TN



# FedEx World Headquarters



# The Project

- 1.1 Million Sq Ft
- 3800 Employees
- 18% Private Offices-82% Open Plan Workstations
- FedEx owned and maintained



# FedEx World Headquarters



# FedEx World Headquarters



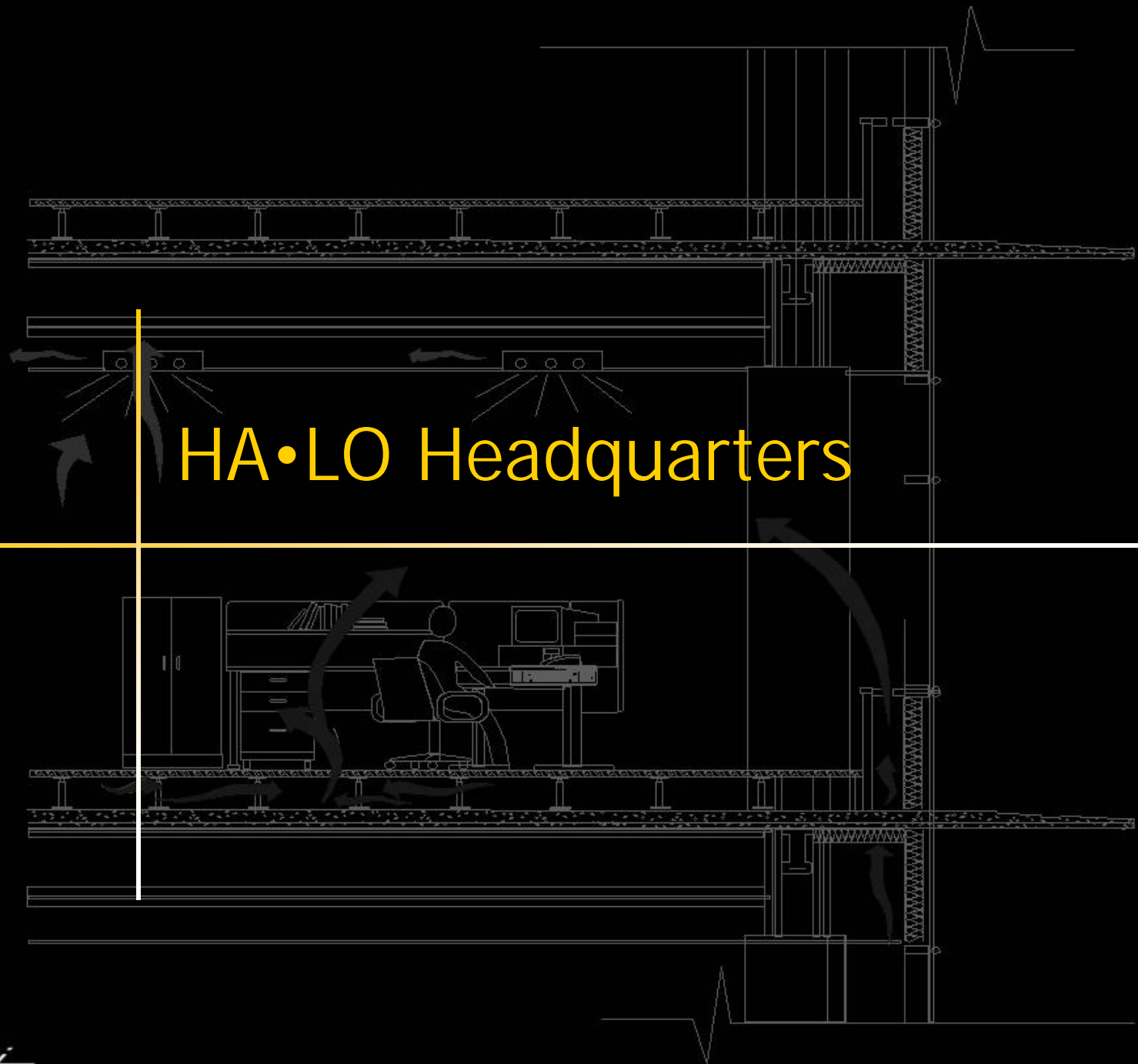
# FedEx World Headquarters





# Why FedEx Chose the Underfloor Air System

- FedEx Culture - People-Service-Profit (PSP)
  - Employee Control Workspace
  - Flexibility
- FedEx Maintenance
- High "Churn" Rate
- Maintenance Control of Temperature





# HA•LO Headquarters

2001 – Occupied  
235,000 sq ft  
Niles, IL



# HA•LO Headquarters

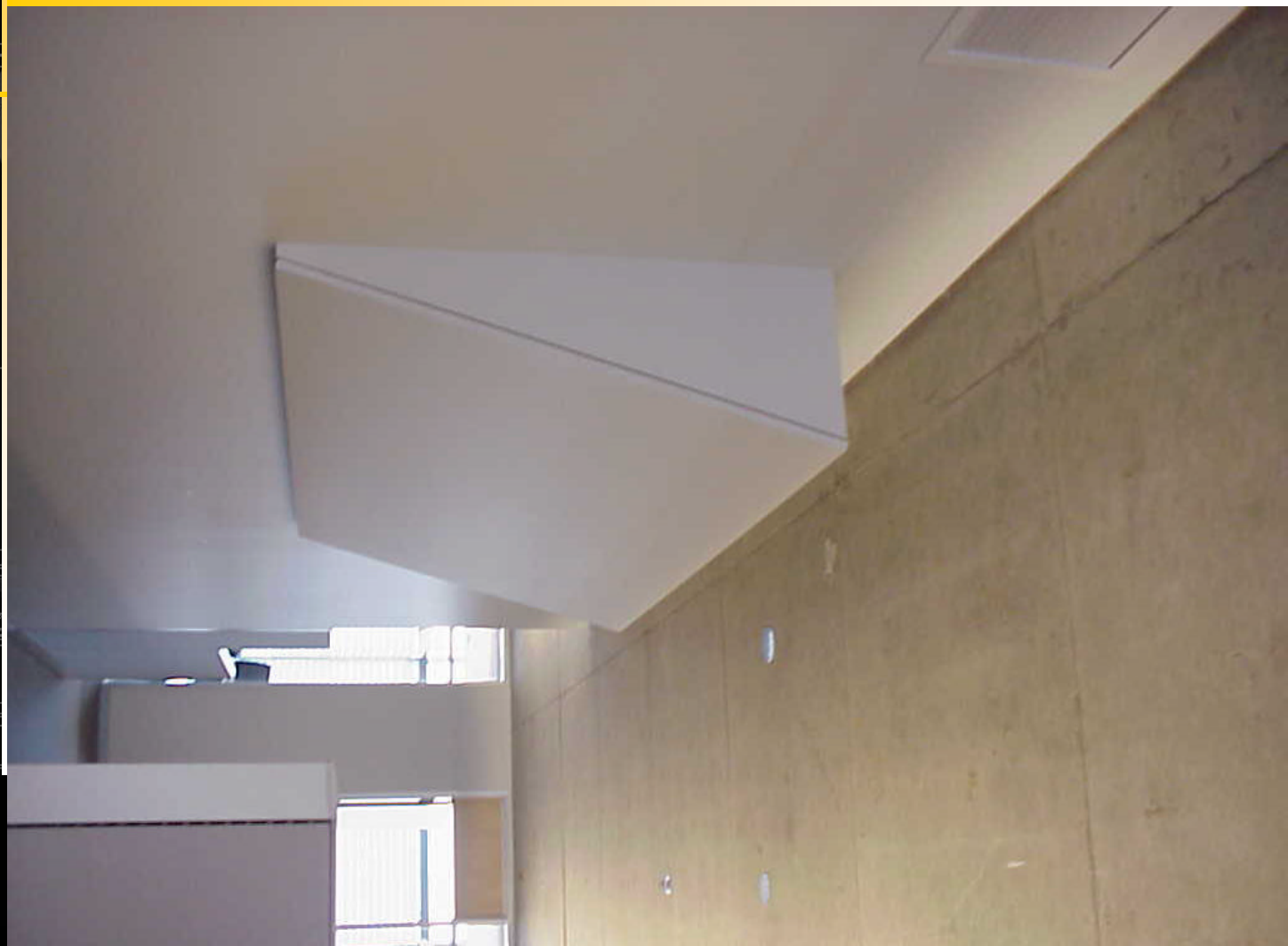


# HA•LO Headquarters





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# HA•LO Headquarters



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# HA•LO Headquarters





# Woodfield Preserve Office Park

# Woodfield Preserve Office Park

2001 – Occupied  
600,000 sq ft  
Schaumburg, IL



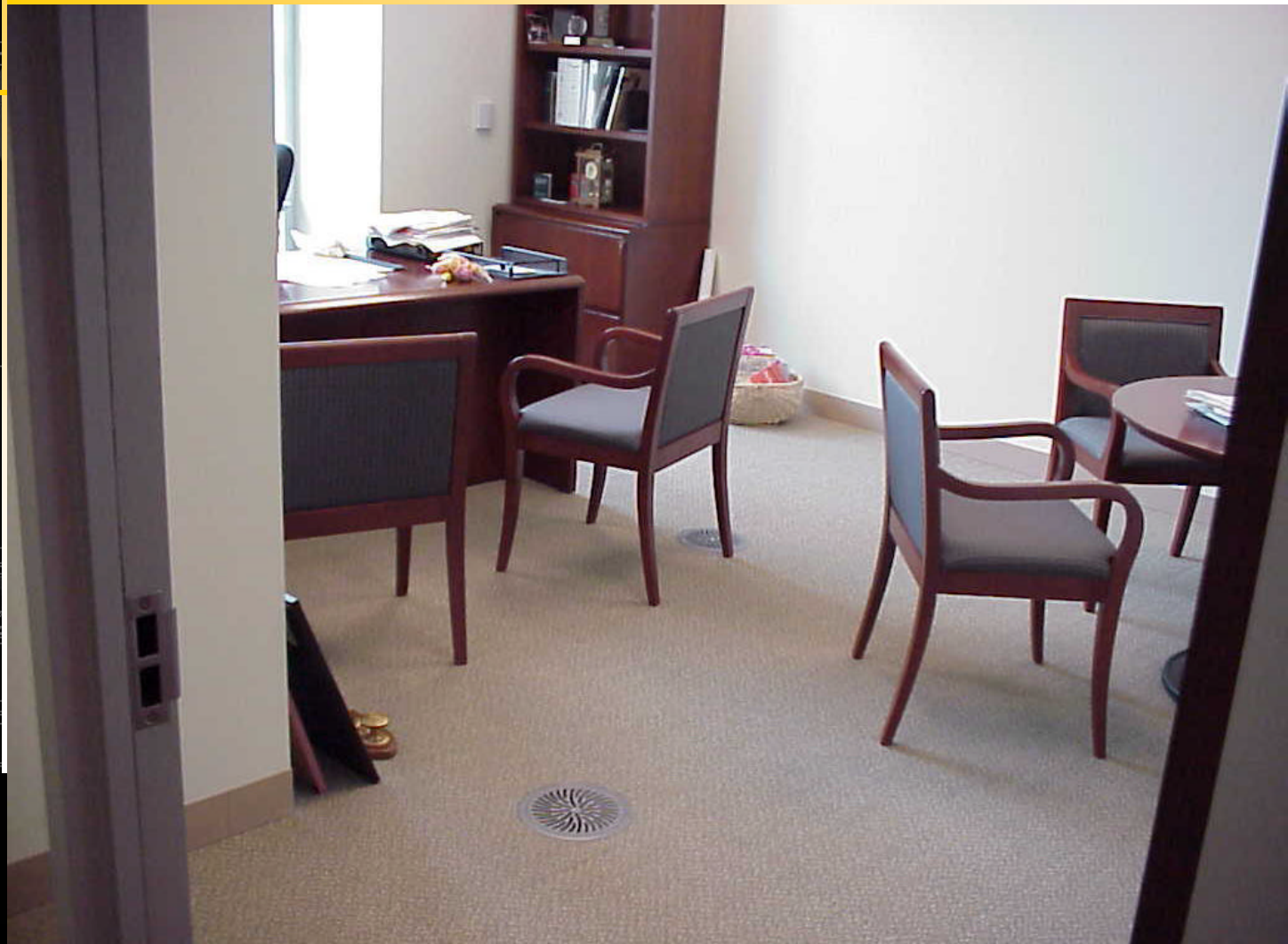


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